

ANTHRAX

By A. E. CAMERON, M.C., V.S.,
CHIEF VETERINARY INSPECTOR

DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE

BULLETIN No. 120—NEW SERIES

HEALTH OF ANIMALS BRANCH
GEO. HILTON, V.S., Veterinary Director General

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ANTHRAX

Anthrax is a severe and usually fatal disease which occurs sporadically and in epizootics. It usually runs an acute febrile course and is caused by the entrance of a germ or its spores into the animal's tissues. The causative organism is known as the *Bacillus anthracis*.

The history of anthrax can be traced through past centuries with little difficulty. Descriptions of epidemics and epizootics of this disease were given by several of the great writers before the Christian era. Human beings were formerly affected in large numbers and extensive outbreaks are mentioned in the literature of the fifteenth, sixteenth, seventeenth, eighteenth and nineteenth centuries. Sixty thousand people near Naples are reported to have died of anthrax in 1617. In San Domingo fifteen thousand persons died of anthrax within six weeks in 1770. This high death-rate is attributed to the consumption of carcasses of animals which had died of the disease.

The micro-organisms causing anthrax were observed in the blood as early as 1849 but it was not until 1863 that they were announced to be bacteria and directly connected with the disease.

During the last twenty-five years outbreaks have been reported in all provinces excepting Prince Edward Island and Manitoba. The disease occurred fairly regularly in Quebec and Ontario until ten years ago since when only odd outbreaks have occurred. Anthrax does not appear to have become indigenous as the following table shows that only isolated cases have occurred since 1920.

ANTHRAX—OUTBREAKS IN CANADA

—	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
1903...	—	—	—	1	4	—	—	1	—
1904...	—	—	1	1	2	—	—	—	—
1905...	—	3	—	1	4	—	—	—	2
1906...	—	—	—	—	—	—	—	—	—
1907...	—	—	—	4	20	—	—	—	—
1908...	—	—	1	5	5	—	—	—	—
1909...	—	—	—	2	7	—	—	—	—
1910...	—	—	—	2	4	—	—	—	—
1911...	—	—	—	5	2	—	—	—	—
1912...	—	—	—	11	3	—	4	—	—
1913...	—	—	—	2	1	—	—	—	—
1914...	—	—	—	15	5	—	—	—	1
1915...	—	—	—	18	8	—	—	—	—
1916...	—	—	—	3	10	—	—	—	—
1917...	—	—	—	4	6	—	—	1	—
1918...	—	—	—	1	1	—	—	—	—
1919...	—	—	—	2	2	—	—	—	—
1920...	—	—	—	—	—	—	—	—	—
1921...	—	—	—	—	—	—	—	—	1
1922...	—	—	—	—	—	—	—	—	2
1923...	—	—	—	—	1	—	—	—	1
1924...	—	—	—	1	—	—	—	—	—
1925...	—	—	—	—	—	—	—	—	—
1926...	—	—	—	—	1	—	—	—	—
1927...	—	—	—	—	—	—	—	—	—
1928...	—	—	—	1	1	—	—	—	—
1929...	—	—	—	—	2	—	—	—	—

More work of an investigational character has been done with anthrax than with any other disease. The organisms are, compared with germs of other

infectious diseases, relatively large and this enabled them to be seen with the lower powered microscope formerly in use. Through the study of these microbes and the improvement of the microscope the whole field of investigation of bacterial or germ disease has been developed.

This organism the *Bacillus anthracis* is a short rod which can be demonstrated in the blood of animals dead of the disease by means of a proper microscope. The germ while visible in an unstained condition is more easily seen and studied when stained with one of the aniline dyes. When stained certain characteristics of the organism are very plainly brought out.

The germ of anthrax grows very readily under artificial conditions on suitable food material. When, however, conditions become unfavourable for its growth through exhaustion of the food supply or when the temperature is unsuitable the organism changes its form into a spore or resisting body. In this spore form the organism can withstand exposure to extreme cold or high temperatures for an extended period. Records are available showing that in this spore form existence has persisted for twenty years and there is good reason to believe that these spores can retain their vitality for a *much longer* period.

OCCURRENCE OF ANTHRAX.—Practically all animals are susceptible to anthrax. Farm animals are especially susceptible in the following order: sheep, horses and cattle. Guinea pigs, rabbits, mice and other animals die quickly from its effects. Hogs, dogs and cats and carnivorous animals in general are less susceptible and may only become infected after repeated exposure. In these animals the disease has a tendency to remain localized. Natural infection in fowls has not been definitely established.

Certain breeds of animals appear to be more resistant than others, for example, Algerian sheep are practically immune. Age has an influence as young animals are more easily infected than older ones. Fatigue, starvation and exposure reduces resistance. Animals unused to hardship such as well fed, carefully stabled and pampered animals appear to be more easily infected than hardier animals. Young animals shedding their teeth and those with any digestive disturbance or inflamed mucous membranes are particularly susceptible to anthrax. In man the disease may occur in a constitutional form but fortunately in many cases it develops only local trouble and may be followed by recovery.

Infection may be brought to a farm in a variety of ways, for instance, by hides, hair, wool, etc., from animals dead of the disease; by dogs or birds which have had access to an anthrax carcass; by means of infected earth adhering to the hoofs of cattle, sheep or horses or to the wheels of vehicles or by infected material adhering to the boots or clothes of persons who visited infected premises. Formerly one of the most commonly reported sources of infection was from water and other waste material coming from tanneries. Tanneries are usually situated on a stream to ensure an ample supply of water for their manufacturing requirements and their waste may be discharged into the stream. It is consequently necessary that all such waste should be disinfecting in catch tanks before being discharged.

Anthrax may occur periodically in a certain locality. Once the disease has occurred there is great danger of its recurrence. If the debris of a dead animal is left on the surface of the ground the spores may remain around the roots of the grass or be washed to low-lying ground. If buried in the body of an animal dead of anthrax some of the germs may be liberated, form spores and be carried by water and subsequently be brought to the surface. The spores may be brought to the surface by earthworms, in the bodies of which they have been found. They may also be spread on the surface by certain snails.

During dry seasons earthworms penetrate deeply into the ground in search of moisture; they may find spores which have been washed there in past years, swallow them and bring them to the surface. Earthworms coming to the surface at the first rains after a dry season may account for outbreaks at that time.

The infective organism is more likely to remain in low lying and marshy lands and those rich in organic matter especially when the lands are subject to inundation. When the water dries up the spores may germinate in the moist exposed surface when the warm days follow. This would explain why outbreaks usually occur in the summer months.

METHOD OF INFECTION

In certain outbreaks a single species of animal may be infected while others are apparently similarly exposed. This is not entirely understood but a possible explanation is that the infected species may crop the pasturage more closely or more readily pull up the roots around which the infection may be lodged. Blood sucking flies also, for example horse flies, may feed almost entirely upon one species of animal and they have been known to transmit the disease.

Anthrax is not often transmitted directly from animal to animal except by blood sucking flies. Such infection would only occur when the blood or excrement of infected animals came directly in contact with injuries on the skin or mucous membrane. The diseased animal is nevertheless a source of danger for its excrement contaminates the food, bedding and ground with which other animals come in contact and so infection is transmitted indirectly.

Animals become infected with anthrax by the entry of the germs into the system through cracks on the lips or injuries in mouth or in the intestines. The feeding of anthrax organisms, however, does not always result in the animal contracting the disease but if the organisms are fed along with rough sharp pointed material such as thistles or briers anthrax will invariably result.

Anthrax rarely develops through skin lesions unless the wounds or abrasions extend completely through the skin. In this way the bacilli or spores enter the tissue fluids and reach the blood circulation.

The manure of infected animals is particularly dangerous as it forms a suitable medium when mixed with earth for the propagation of bacilli and also for the formation of spores.

In parts of the country where dogs or coyotes are numerous it is important to properly dispose of the carcasses of animals dead of anthrax as dogs and coyotes, while resistant themselves, pass the virus out with their droppings and also carry or drag pieces of meat long distances and contaminate the ground.

In infected districts the intestinal contents of healthy animals may contain spores which have been swallowed with the food or water without causing the disease. This is very likely to happen if the animals have been immunized. These animals may therefore spread the contagion into uninfected places without themselves developing the disease.

When spores reach the intestines they may germinate into bacilli and may then penetrate into the submucous tissue through the mucous glands and cause infection.

DIAGNOSIS

Anthrax runs its course so rapidly that it is hardly possible to definitely diagnose the disease in the living animal. An apparently well animal may be found dead in the morning. If carefully observed however it may be noticed that there is something amiss a few hours before death. A very high temperature, even up to 108 F. or 110 F. may be expected about twenty-four hours before death.

Just before or immediately after death bloody discharges may be seen coming from the natural openings of the body. When these are seen one must be very careful as in anthrax these bloody discharges teem with the causative germs so that the ground becomes contaminated and other animals and man may become infected.

In less acute cases anthrax is indicated principally by the rapidly extending edematous swellings as well as the bloody urine and feces.

It is necessary to differentiate anthrax from sudden deaths resulting from other causes. Lightning, sunstroke, poisoning, acute congestion of the lungs, haemorrhage into the brain and other causes may kill animals with similar manifestations. The owner may suspect that his animal has been poisoned by an enemy.

Haemorrhagic septicaemia may closely resemble anthrax as swellings may occur in this disease as well as bloody feces and urine. In horses severe intestinal inflammations especially if accompanied with blood in the feces may cause a suspicion of anthrax. Particularly is this the case in infected districts where cases of anthrax occur in which there are no characteristic symptoms other than colic.

In cattle blackleg and malignant edema are differentiated by the cold and crackling consistence of the swellings in these diseases. The swellings, when they occur in anthrax, are doughy to the touch.

One may be led to suspect anthrax when an animal dies suddenly and is observed to have a bloody discharge from the mouth, nostrils or anus. These conditions should arouse suspicion and make the stockowner exceedingly careful in handling the carcass so as to avoid infecting himself or others or distributing the infection over the ground if removing the carcass for burial.

When a suspicion of anthrax exists, a few drops of blood on a sheet of clean notepaper, allowed to dry in the air, is sufficient to permit of examination for diagnosis in a laboratory. The notepaper with the blood must be folded up and placed in an envelope. Mark the outside of the envelope DANGEROUS—SUSPECTED ANTHRAX and also write the name of the owner and the kind of animal; horse, cow, sheep, etc. The envelope containing the blood specimen should then be wrapped in paper, placed in another envelope together with a letter giving further details and forwarded to the nearest laboratory or to the Animal Diseases Research Institute, Hull, Quebec.

A careful study should be made of the regulations relating to anthrax, which are appended, for the purpose of safeguarding the interests of all parties concerned.

If anthrax is suspected a post mortem should not be conducted as it is a very dangerous procedure. If, however, a post mortem examination were carried out blood stains would be noted throughout the tissues and organs of the body. The spleen would be found to be greatly enlarged, very dark or black in colour and the blood tarry in appearance. The blood does not clot after death.

DISPOSITION OF CARCASSES

The carcass of such an animal should be destroyed by fire as soon as the diagnosis is made or suspected, care being taken that all discharges and litter about the animal be burned with it even to the halter. The animal should not, under any consideration, be skinned, as this is a most dangerous procedure; nor should it be dragged over the farm with a chain around the neck or leg that a spot may be found where digging is easy, for by this means the infection is spread, contaminating any enclosure through which the animal may be drawn.

If it is necessary to move a carcass in order that it may be burned with safety the natural openings should be carefully plugged and the carcass rolled

over on to an old "stoneboat", which can also be burned. The soil where the carcass lay should be soaked with strong disinfectant and thickly covered with lime.

Deep burial is sometimes resorted to and in such a case the carcass should be entirely covered with quicklime and have at least six feet of earth above it. Burial is not nearly so satisfactory a method as burning as there is always danger of infecting the ground and having a recurrence of the disease maybe years later.

Areas where anthrax carcasses have been improperly buried may be considered as infected areas and should be fenced.

An effective method of disinfecting flooring or even infected ground of moderate extent is to go over it slowly with a blow torch, such as is used by plumbers. Even wood can be treated in this manner if care is exercised.

TREATMENT.

An opportunity to treat animals affected with anthrax is seldom present and when such opportunity is afforded it is usually fruitless. Should the resistance of the animal be great and death be delayed, no system of treatment is likely to result satisfactorily.

The complete separation of the healthy animals from those which are sick and their removal from the infected ground will frequently check an outbreak.

ANTHRAX VACCINES

Anthrax can be prevented by the use of vaccines, aggressins or anti-serums.

Anthrax vaccines properly used afford protection or immunity to a subsequent artificial or natural anthrax infection. Anthrax vaccines are attenuated or weakened cultures of the germs causing anthrax (*Bacillus anthracis*) or their attenuated spores.

To protect or immunize an animal against anthrax the vaccines are inoculated into the animal and the immunity or protection is the result of a mild attack of the disease which as a rule causes little inconvenience to the patient save a slight elevation of temperature. During this time it is advisable to take particular care of the animals, protecting them from extremes of heat or cold, etc.

Aggressins are made from tissue fluid of an infected animal. They are filtered and standardized and produce a high degree of resistance to infection. Anthrax anti-serum is made by injecting a vaccine into an animal and subsequently giving gradually increasing doses of the virulent organisms until a high degree of immunity is produced. The serum from such an animal when injected into a susceptible animal gives a temporary immunity and may even cure the disease if it has not become generalized. Anti-serums are sometimes used in combination with vaccines when an outbreak is in progress.

Vaccines or aggressins used upon an animal already affected with anthrax will not protect such an animal nor will they prevent its death. The use of these products during or immediately after the occurrence of an outbreak of anthrax may be followed by death in some instances due to the stimulation of the anthrax germs already in the system of the animal and such accidents cannot be prevented. Before using them it is well to take the temperature of the animal to be vaccinated immediately before inoculating and in the event of the tempera-

ture being elevated inoculation should be deferred until the temperature of the animal is again normal. The use of anthrax anti-serum would be of value in such cases.

Years ago vaccines were manufactured and sold by the Department of Agriculture. This work was undertaken to enable stockowners to obtain reliable anthrax vaccine, when required, at a nominal charge. The making of anthrax vaccine by the department has been discontinued as it is no longer necessary. Reliable anthrax aggressins, anti-serums and vaccines are now manufactured by commercial institutions and can be purchased through local agencies, veterinarians and druggists. The Department of Agriculture is satisfied an ample supply of these products, reliable and efficient in affording protection, is now available through the ordinary commercial channels.

It is of course important that the manufacturer's instructions as to dosage and method of use, etc., covering the particular product should be carefully followed, and in dealing with such a disease as anthrax stockowners would be well advised to obtain the services of a competent veterinary practitioner in every case. It is of the utmost importance that sterilized hypodermic needles are used when inoculating animals as if one animal was infected and the same needle used without proper disinfection the disease might be transmitted and develop before immunity was established by the aggressin or vaccine used.

ANTHRAX IN MAN

In man anthrax is usually seen as a local infection in the skin and nearby tissues. The persons most liable to infection are those who come in contact with diseased or dead animals. Veterinarians, herders, butchers, and labourers who work on hides, hair, bristles, or wool are most commonly victims of accidental infection. Intestinal infection is rarely seen in man although an infection of the lungs may take place from the inhalation of infected dust.

Anyone suspicious of being infected with anthrax should consult a physician without delay in order that a proper diagnosis may be made and suitable treatment applied. The treatment usually consists of the surgical removal of the local point of infection or the treatment with a serum prepared for this disease.

Veterinarians, farmers and others who have reason to suspect the existence of anthrax are compelled, under the Animal Contagious Diseases Act, to promptly notify the Minister of Agriculture, the Veterinary Director General, or the nearest Veterinary Inspector.

DOMINION OF CANADA

REGULATIONS RELATING TO ANTHRAX

By Order in Council dated 22nd July, 1911, in virtue of "The Animal Contagious Diseases Act, R.S.C., 1906"

1. No animal which is affected with or has been exposed to the contagion of anthrax shall be permitted to run at large or to come in contact with any animal not so affected or exposed.

2. Any inspector may declare to be an infected place within the meaning of "The Animal Contagious Diseases Act" any place or premises where the contagion of anthrax is known or suspected to exist.

3. No animal nor any portion or product thereof shall be removed out of any place so declared to be an infected place without a license signed by an inspector.

4. Inspectors are hereby authorized to inspect any animals affected with anthrax or suspected of being so affected, or which have been in contact with animals so affected, or suspected of being so affected or which have been in any way whatever exposed to the infection of anthrax, and may order any such animals to be collected, detained, isolated, or otherwise dealt with as may to them appear advisable.

5. The expenses of, and incidental to the collection, isolation, seizure, or otherwise dealing with animals for the purposes of these regulations shall be borne by the owners of the animals and no indemnity shall be allowed to the owner in case of damage arising out of or resulting from such actions except as hereinafter provided.

6. Where a veterinary inspector so orders no animal or animals shall be allowed access to any field, common, yard, stable, or other place or premises where anthrax exists or has existed.

7. Carcasses of animals dying from anthrax, or suspected anthrax, must not be skinned, or cut in any way; such carcasses together with all litter, excreta and other articles which may have been in contact with them, must be dealt with in accordance with the orders of the veterinary inspector and in a manner satisfactory to him.

8. Premises on which animals affected with anthrax have been kept are to be dealt with at the expense of the owner or occupier, in a manner satisfactory to the veterinary inspector.

9. Animals affected with anthrax or which have been in contact with or in close proximity to animals affected with anthrax, may, on an order signed by a veterinary inspector, duly appointed under the Animal Contagious Diseases Act, be forthwith slaughtered and the carcasses disposed of as in such order prescribed, compensation to be paid to the owners of such animals if and when the Act so provides, but no inspector shall order the slaughter of such animals without having first received from the Minister special authority to do so.

10. Before an order is made for the payment of compensation in any of the cases aforesaid, there must be produced to the Minister of Agriculture a satisfactory report, order for slaughter, certificate of valuation and slaughter, and certificate of cleansing and disinfection, all signed by an inspector.

11. Any inspector may declare any steamship, steam or other vessel, railway car or other vehicle, on or in which animals affected with or suspected of being affected with anthrax, are or have been placed for the purpose of transit, to be infected, and may also declare such vessel, car or other vehicle, to be no longer infected after it has been thoroughly cleansed and disinfected in accordance with his instructions.

12. Every, yard, stable, cowshed, outhouse, or other place or premises, and every wagon, cart, carriage, car, or other vehicle, and every utensil or other thing infected or suspected of being infected with anthrax shall be thoroughly cleansed and disinfected by and at the expense of the owner or occupier in a manner satisfactory to an inspector.

GEORGE HILTON,
Veterinary Director General.

HEALTH OF ANIMALS BRANCH,
DEPARTMENT OF AGRICULTURE,
OTTAWA.

Attention is Specially Directed to the following Sections of "The Animal Contagious Diseases Act, R.S.C., 1906"

SECTION 3. Every owner of animals and every breeder of or dealer in animals, and everyone bringing animals into Canada, shall, on perceiving the appearance of infection or contagious disease among the animals owned by him or under his special care, give immediate notice to the Minister and to the nearest veterinary inspector of the Department of Agriculture of the facts discovered by him as aforesaid.

(2) Any veterinary surgeon practising in Canada shall, immediately on ascertaining that an animal is labouring under an infectious or contagious disease, give similar notice to the Minister and to the nearest veterinary inspector.

SECTION 4. Every owner of such diseased animals who neglects to comply with the provisions of the last preceding section shall forfeit his claim to compensation for any animals slaughtered in accordance with the provisions of this Act; and no such compensation shall be granted to him.

SECTION 23. Whenever under this Act a place has been constituted an infected place, no live animal, nor the flesh, head, hide, skin, hair, wool or offal of any animal or any part thereof, nor the carcass nor any remains of any animal, nor any dung of animals, nor any hay, straw, litter or other thing commonly used for and about animals, shall be removed out of the infected place without a license signed by an inspector appointed as aforesaid, until said place has been released by order of the Minister.

SECTION 35. Every person who neglects to give notice, as required by this Act, of any facts discovered or perceived by him indicating the appearance or the existence of infectious or contagious disease among animals owned by him or under his special care, or who conceals the existence of infectious or contagious disease among animals, shall incur a penalty not exceeding two hundred dollars.

SECTION 36. Every person who turns out, keeps or grazes in or upon any forest, wood, moor, beach, marsh, common, waste land, open field, road-side, or other undivided or unenclosed land, any animal, knowing it to be infected with

or labouring under any infectious or contagious disease, or to have been exposed to infection or contagion, shall, for every such offence, incur a penalty not exceeding two hundred dollars.

SECTION 37. Every person who brings, or attempts to bring into any market, fair or other place, any animal known by him to be infected with or labouring under any infectious or contagious disease, shall, for every such offence, incur a penalty not exceeding two hundred dollars.

SECTION 38. Every person who sells or disposes of, or puts off, or offers or exposes for sale, or attempts to dispose of or put off, any animal infected with or labouring under any infectious or contagious disease, or the meat, skin, hide, horns, hoofs or other parts of an animal infected with or labouring under any infectious or contagious disease at the time of its death, whether such person is the owner of the animal, or of such meat, skin, hide, horns, hoofs or other parts of such an animal, or not, shall, for every such offence incur a penalty not exceeding two hundred dollars.

SECTION 41. Every person who refuses to admit any inspector or other officer into any place or premises or any steamship, vessel or boat, or any carriage, car, truck, horse-box, or other vehicle used for the carriage of animals, or who obstructs or impedes the execution of any order or regulation made by the Governor in Council or the Minister under this Act, shall for every such offence incur a penalty not exceeding one hundred dollars; and the inspector or other officer may apprehend the offender and take him forthwith before a justice of the peace to be dealt with according to law; but no person so apprehended shall be detained in custody without the order of a justice longer than twenty-four hours.

SECTION 46. Every person who violates any provision of this Act, or of any regulation made by the Governor in Council or by the Minister, under the authority of this Act, in respect to which no penalty is hereinbefore provided, shall, for every such offence, incur a penalty not exceeding two hundred dollars.

